DISCUSS THE DIVERSITY OF LEPIDOPTERA AT DIFFERENT ALTITUDES IN JAMMU REGION

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ABSTRACT

The Himalayan region's butterflies have been examined in depth, particularly inside the Indian subcontinent. The order Lepidoptera includes the insects often known as butterflies. Patterns of ribbons, nodes, and circles, among other colors, are generated by the scales. As a result of their rarity and the huge demand for their colorful wings, several species of butterflies have been labeled endangered because of human activity. Researchers in the Hills of Jammu area did this study to document the diversity of butterfly species found there. Over the course of three days, researchers collected samples from the ground at 400–500 meters (lower altitude), 750–850 meters (middle height), and 1000–1250 meters (higher altitude) in the study region. During the hours of 0900 and 1700 UTC, the butterfly net was used to randomly gather the insects from the air.

Keywords: Butterflies, Himalaya, Altitude, Lepidoptera, Habitat

I. INTRODUCTION

In the world of insect preservation, butterflies have the title of "flagships." While only accounting for 1.87 percent of the world's insect species, they serve as prototypes in the vast majority of ecological entomology and habitat conservation research. Their widespread appeal is mirrored in the ways that people view the world, value culture, and respects the natural world. Butterflies, unlike birds and animals, are highly prized by nature lovers owing of their vibrant hues, and as a result, they may invoke the ‘vertebrate' approach to insect conservation. Their unique biotic and abiotic characteristics not only add to their aesthetic appeal, but also make them reliable markers of changes in both habitat and climate.

Butterflies can stand in for other animals in conservation efforts because of their illustrative qualities. The Indian Himalaya (IH) is home to a plethora of butterfly species, many of which are unique to the region, in part because of the wide variety of habitats found there. This ranges from the arid Trans and western side to the verdant cloud forests of the eastern Himalaya. Many of them, especially those in the subfamily Parnassinae, are facing serious risks as a result of the current climate change scenario. To ensure their survival in the wild, it is crucial to keep tabs on their numbers and whereabouts at all times. There is a number of substantial researches on various aspects of Himalayan butterflies, however they tend to be limited to a particular area. The basis for any future monitoring effort in this delicate ecosystem must be laid with accurate and comprehensive data, and this includes the variety and distribution pattern of Himalayan butterflies.

In their position as pollinators, which aid in the natural reproduction of plants, butterflies play a significant role in the preservation of biodiversity. Also, birds, reptiles, spiders, and other predatory insects rely heavily on butterflies for sustenance. Butterflies are often used as bio indicators of the change in quality of the environment, making them an important conservation focus.

II. LEPIDOPTERA

Lepidoptera is the second most abundant insect order, behind Coleoptera one of the most common and easily recognized orders of insects. Linnaeus first used the name "lepidopteron" in 1875 to describe the group of insects that includes both

moths and butterflies because of the flattened hairs (scales) that cover the body and wings of most adults. As one of the most frequently documented insect groups, butterflies have been the subject of much research. The constant discovery of new butterfly species and the ongoing arguments amongst taxonomists over the status of numerous species both contribute to the list's ever-increasing size.

Lepidopterans, which include butterflies and moths, are one of the most abundant orders of insects. However, the dispersion of these winged creatures is highly dependent on the accessibility of the plants they feed on. You can find them anywhere save Antarctica and the very top of the Arctic. Bugs like these may be found everywhere there are plants, from tropical rainforests to arctic tundra, and they are especially fond of Angiosperms, the blooming plants that make up the majority of the plant kingdom (flowering plants).

As a result of the lack of cross veins, the surface of a Lepidopteran butterfly's wing is not often subdivided into cells. The bases of the Radius, Median, and Cubitus veins, however, frequently merge together to produce a single basal cell. Countless multicolored scales and numerous hairs adorn the wings. The scales are stacked in a shingle-like fashion, with each one covering the one below it. Each scale is joined to the wing membrane by a slender shaft that fits into a corresponding socket, much like a feather in a bird. Each scale's surface is textured like a honeycomb thanks to a pattern of five longitudinal ridges interspersed with finer ridges.

Melanins provide the primary coloring for the flat, pigmented scales. The lepidopteran's own melanins are responsible for their dark colours. The integumentary yellows, oranges, and reds come straight from the source plant. The interference of light is responsible for the majority of the blue, purple, green, and metallic colors. It is the structural scales, which are more common in males that provide the blue-green hues. Androconial (or scent) scales, which are seen most frequently on males, are linked at their bases to secretory glands; these glands store chemicals called pheromones, which are typically used by males during courting display in order to attract females. As a result of their varied wing patterns, many species of butterflies may be easily identified. A visual assistance for courting and mating, the wing color patterns help pair off the right birds. The male's elaborate, multicolored patterns function as signaling devices across great distances.

III. MATERIALS AND METHODS

Study site

This study was carried out along the Hills of Jammu region.

Data collection

The samples were collected over the course of three days at each of the three elevations (400-500 m, 750-850 m, and 1000-1250 m) during the active biological hours of butterflies. These examples of butterflies were hand-caught using butterfly nets during the day. In addition, overripe pineapples were employed as food bait in traps to snag butterfly specimens. The daylight DOs focused on the high-flying, fast-moving butterflies. After a successful collection, each individual was killed by squeezing its thorax with the fingers and thumb. The paper envelope was folded into a triangle, and the specimen was then placed inside. Envelopes were neatly organized and put in a plastic bin with labels. After returning to the UKM lab, the voucher specimens were pinned, oven-dried, and finally identified to the species level. Common references were used to determine the correct taxonomic classification.

Data analysis

Using the Past programme, we were able to examine the species diversity, species richness, and species evenness of the butterflies across elevations. An assessment of species diversity the Shannon-Weiner index (H') combines richness and evenness into a single metric. The Shannon-Weiner Evenness Index quantifies how evenly distributed species are, whereas the Margalef Index (R') provides an approximation of species richness.

IV. RESULTS AND DISCUSSIONS

A total of 138 species of butterflies representing five families (Papilionidae, Pieridae, Nymphalidae, Hesperiidae and Lycaenidae) and 14 subfamilies (Papilioninae, Nymphalinae, Satyrinae, Danainae, Morphinae, Coliadinae, Pierinae, Riodininae, Miletinae, Poritiinae, Lycaeninae, Pyrginae, Hesperiinae and Coeliadinae) have been recorded from the three altitudes, 400 m to 500 m (lower altitude), 750 m to 850 m (middle altitude), and 1000 m to 1250 m (higher altitude) in the study area.

Table 1: Family composition of butterflies showing number of species and individuals recorded from the Hills of Jammu region during the study period

Family	No. of species	No. of Individuals
Papilionidae	11	21
Nymphalidae	51	403
Pieridae	19	102
Lycaenidae	37	163
Hesperiidae	20	27
TOTAL	138	716

During the research period, 716 individuals and 138 species of butterflies from five families were counted. With 51 species and 403 individuals recorded, the Nymphalidae family was the most prevalent and numerous, followed by the Lycaenidae (37 species and 163 individuals), the Hesperidae (20 species and 27 individuals), the Pieridae (19 species and 102 individuals), and the Papilionidae, a small family with the fewest species (11 species and 21 individuals) (Table 1). Lycaenidae, Hesperiidae, and Nymphalidae are the families with the most species and the most evenly distributed species in the tropical rainforest ecosystem. However, there are fewer nymphalids and lycaenids in temperate rainforests than in tropical rainforests.

Table 2: Percentage contribution of butterfly species at different altitudes recorded in the study area

Altitude	Total number of species	Percentage (%) of species
E1	82	59.4
E2	57	41.3
E3	67	48.6

The diversity of habitats linked to sunshine availability and an abundance of host and food plants for the butterflies likely contributed to the spatial variation in the number of species observed across elevations (Table 2). Some butterfly species, such as those in the Nymphalidae and Lycaenidae, do not like the cold and damp circumstances that are common at the higher altitudes. Higher altitudes have more rainfall and rainy days than lower altitudes.

Lower elevations have a more varied flora than higher elevations. The presence of adult nectar plants and host plants for larvae determines which environments butterflies choose as well as how quickly they grow. The distribution and diversity of butterflies and other invertebrates may also be impacted by changes in plant structure and composition related to altitude and climatic conditions including temperature, humidity, rainfall, and sunlight. The existence of a small stream and waterfall at both heights, where numerous butterflies were seen to cluster around these water bodies, is likely what caused the increased counts of butterfly species recorded at E1 and E3 compared to other sites.

Table 3: Shannon-Weiner Diversity Index (H'), Shannon-Weiner Evenness Index (E'), Margalef's Richness Index (R') for butterflies at three different altitudes

No.	Altitude (m)	No. of species	H’	E’	R’
1	E1	82	3.917	0.613	14.720
2	E2	57	3.226	0.442	9.756
3	E3	67	3.683	0.594	13.000

Table 3 demonstrates that, when compared to the other two elevations, E2 and E3, E1 has the greatest values of the Shannon Diversity Index (H'), Margalef's Richness Index (R'), and Shannon Evenness Index (E'). There are no significant differences between H' of E1 and E2, between E2 and E3, or between E1 and E3, according to a T-test (=0.05) investigation. According to Tews et al. (2004), higher variability and heterogeneity in the plant cover will impact the variety and abundance of butterflies. However, our findings showed that there were no significant changes for H', E', and R' across the elevations ($p>0.05$, =0.05). This might imply that due to the very limited region studied, where each height was only 100–250 m away from the next, there were no appreciably different variances and heterogeneity in plant cover across the elevations. The butterfly species were able to migrate freely because of how close the elevations were to one another.

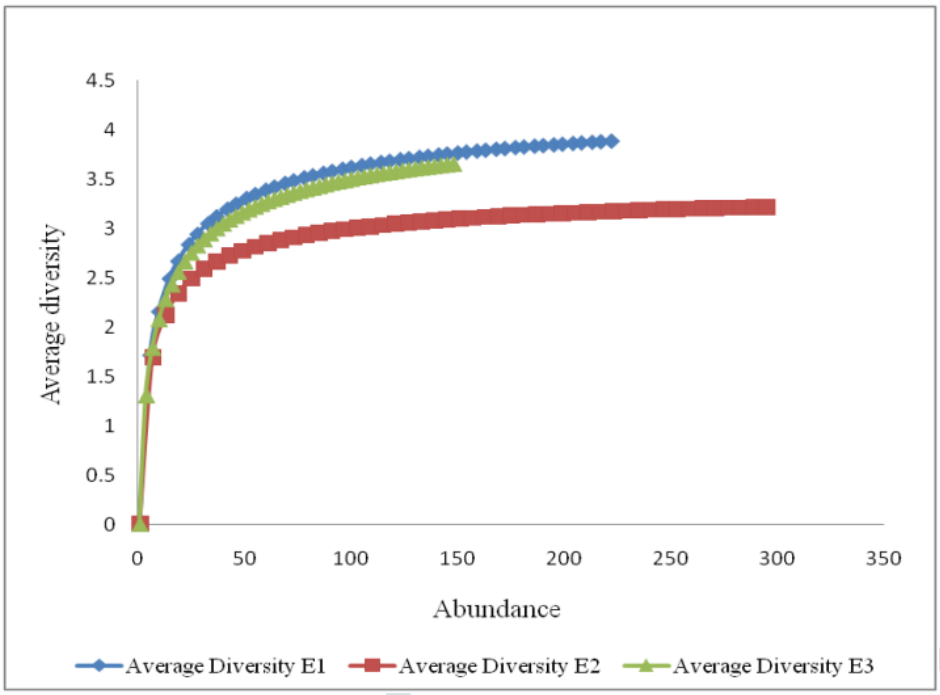

Figure 1: Species accumulation curves (SAC) for average diversities at three different altitudes, E1, E2, and E3

The average diversities at three elevations, 400–500 m (E1), 750–850 m (E2), and 1000–1250 m, are shown by accumulative curves in Figure 1. (E3). The species accumulation curves (SAC) in Figure 1 showed a sharp rise in the initial number of species collected, increasing relatively uniformly across all altitudes and overlapping at the curves' beginning slopes. The SAC for E2 was the longest and pointed in the direction of the asymptote since there were more species there than at any other altitude. Because E2 may have had better and more extensive sampling attempts than the other research sites, the resultant curve was closer to the asymptote. To ascertain the true species diversity in a sizable study region, it has been recommended that ongoing and intensive sampling efforts are required. Although there may be thousands of species present in a region with extremely varied assemblages, the SAC may not be an appropriate indicator for expressing species diversity in that area. As a result, even after extensive sampling, an asymptote is not obtained.

V. CONCLUSION

The results of this study have improved our understanding of butterflies and offered a more up-to-date and comprehensive list of local butterfly species. To obtain better data for effective conservation efforts to protect endangered species like Rajah Brooke's Birdwing (Troides (Trogonoptera) brookiana trogon Rothschild), the tree Nymph Idea stolli logani (Moore), and Idea hypermnestra linteata (Butler), which have been listed as protected species under the Wildlife Conservation Act 2010, further studies should be conducted with detailed physical and biological parameters, more locations, and higher altitudes.

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